

CLAIMS

Having thus set forth and disclosed the nature of this invention, what is claimed is:

1. An evaporable foam pattern assembly for use in a process of casting a one-piece article in a mold filled with flowable particulate molding material, said assembly comprising:
 - a) a first foam pattern section including a first recess pattern portion and an adhesive surface pattern adapted to be joined to an adhesive surface pattern of a second foam pattern section having a second recess pattern portion that is registered with said first recess pattern portion to define said article when said adhesive surface patterns of the first and second foam pattern sections are adheringly joined,
 - b) said registered first and second recess pattern portions defining an outer shaped surface pattern of the article, and an inner shaped surface pattern of the article that is connected to an inlet end section of a tubular passageway cavity pattern that forms a fluid flow path from the inner shaped surface through an outlet end section of the tubular passageway cavity pattern that extends openly and outwardly through the outer shaped surface pattern, and
 - c) located at said inlet end section of said tubular passageway cavity pattern are means for enhancing movement of particulate molding material from said inner shaped surface pattern into said passageway cavity pattern during said casting process to form a passageway fluid connection section within said article along said fluid flow path when molten material is poured into said mold to evaporate and replace the evaporable pattern assembly to produce said article.
2. A foam pattern assembly as defined in claim 1 wherein
when said first and second foam pattern sections are joined, said outer shaped surface pattern

defines a pattern body having a parting surface between said foam pattern sections that forms a parting line around the outside periphery of the outer shaped surface pattern, and

said tubular passageway cavity pattern is effective to form said passageway fluid connection section which is intersected by said parting surface of the pattern body.

3. A foam pattern assembly as defined in claim 1 wherein

said means for enhancing movement of the particulate molding material includes diverging wall means that openly connects to the inner shaped surface pattern and diverges outwardly from said tubular passageway cavity pattern into said inner shaped surface pattern.

4. A foam pattern assembly as defined in claim 1 wherein

said tubular passageway cavity pattern formed by said registered first and second recess pattern portions includes first and second passageway pattern sections each connected to an opposing side of the inner shaped surface pattern, and

said means for enhancing movement of the particulate molding material is located at an inner end of each said first and second recess pattern portion.

5. A foam pattern assembly as defined in claim 4 wherein

said passageway pattern sections are effective to form a continuous fluid flow path that extends through each said passageway pattern section, said inner shaped surface pattern, and said outlet end section of the tubular passageway cavity pattern, and

said passageway pattern sections are effective to receive an amount of flowable particulate

molding material during the casting process that is sufficient to produce a compacted particulate mass that assumes a shape defined by said passageway pattern sections.

6. A foam pattern assembly as defined in claim 5 wherein

said inner shaped surface pattern includes a cylindrical surface pattern section to which said first and second passageway pattern sections are connected to form said continuous fluid flow path.

7. A foam pattern assembly as defined in claim 1 wherein

said one-piece article is a brake caliper housing, and

said inner shaped surface pattern includes at least two inner cylindrical surface patterns,

said tubular passageway cavity pattern includes a first passageway cavity pattern section disposed on a first side of said cylindrical surface patterns, and second passageway cavity pattern section disposed on a second, opposed side of said cylindrical surface patterns wherein each said first and second passageway cavity pattern section produces tubular passageway means enclosed within said casting after the casting process, and

each said passageway cavity pattern section includes an inlet end pattern portion and a fluid connection pattern portion,

each said inlet end pattern portion openly connects to each said inner cylindrical surface pattern,

each said fluid connection pattern portion includes an outlet end pattern section that extends openly and outwardly through said outer shaped surface, and

said passageway cavity pattern sections are effective to form a continuous fluid flow path that

extends through said outlet end pattern section of each said passageway cavity pattern section, and through said inlet end pattern portion of each said passageway cavity pattern section that openly connects to each said cylindrical surface pattern.

8. A foam pattern assembly as defined in claim 7 wherein
said tubular passageway means of the brake caliper housing includes an inner surface, and
said first and second passageway cavity pattern sections are effective to receive an amount of flowable particulate molding material that is sufficient to produce a compacted particulate mass that assumes a shape defined by the inner surface of said tubular passageway means having a diameter of less than about 6.0 mm.

9. A foam pattern assembly as defined in claim 7 wherein
said tubular passageway means of the brake caliper housing includes an inner surface, and
said first and second passageway cavity pattern sections are effective to receive an amount of flowable particulate molding material that is sufficient to produce a compacted particulate mass that assumes a shape defined by the inner surface of said tubular passageway means having a diameter in the range of from about 4.0 mm to about 6.0 mm.

10. A foam pattern assembly as defined in claim 9 wherein
the average size of said diameter of the tubular passageway means is about 4.5 mm.

11. A foam pattern assembly as defined in claim 7 wherein

said at least two inner cylindrical surface patterns are longitudinally spaced with respect to each other along a single longitudinal center axis.

12. A foam pattern assembly as defined in claim 11 wherein

said first and second passageway cavity pattern sections have substantially identical inner shaped surfaces that are symmetrically located with respect to each other on opposed sides of each said cylindrical surface pattern.

13. A foam pattern assembly as defined in claim 7 wherein

when said first and second foam pattern sections are joined, said outer shaped surface pattern defines a pattern body having a parting surface between said foam pattern sections whereby a parting line is formed around an outside periphery of the outer shaped surface pattern, and said tubular passageway cavity pattern is intersected by said parting surface,

said first and second passageway cavity pattern sections have substantially identical inner surface shapes that are symmetrically located with respect to each other on opposed sides of said cylindrical surface patterns, and

when said foam pattern sections are viewed in elevation along said parting surface, said tubular passageway cavity pattern includes a substantially identical U-shaped portion, and each said outlet end pattern section is substantially straight with one end thereof openly connected to each said U-shaped portion and the other end thereof opening outwardly through said outer shaped surface pattern.

14. A foam pattern assembly as defined in claim 7 wherein

when said first and second foam pattern sections are joined, said outer shaped surface pattern defines a pattern body having a parting surface between said foam pattern sections whereby a parting line is formed around an outside periphery of the outer shaped surface pattern, and said tubular passageway cavity pattern is intersected by said parting surface,

said at least two inner cylindrical surface patterns are longitudinally spaced with respect to each other along a single longitudinal center axis,

said first and second passageway cavity pattern sections each further includes an inner end surface pattern portion that openly connects to opposed sides of said cylindrical surface patterns,

each said inlet end pattern portion being located along a respective plane of said parting surface with each respective plane being disposed in a direction that is parallel to said longitudinal center axis whereby said respective planes intersect each other along a line that is parallel to said longitudinal center axis.

15. An evaporable pattern device for producing a one-piece disc brake caliper casting having an outer shaped surface, an inner shaped surface including an inner cylindrical surface, and enclosed tubular-shaped passageway means for openly connecting the inner cylindrical surfaces to the outside of the caliper casting to define a continuous crossover fluid flow path extending from one side of the caliper casting to the other side of the caliper casting, said pattern device comprising:

a) a pattern body including an outer surface pattern that conforms to the outer shaped surface of said caliper casting, and an inner cavity pattern that conforms to the inner shaped surface of said caliper casting;

b) said pattern body including two pattern body sections that fit together along a parting surface between said pattern sections to form a parting line along said outer surface pattern that produces a visible line along said outer shaped surface around the outside periphery of said caliper casting;

c) said inner cavity pattern including a cylindrical surface pattern section, and first and second passageway pattern sections having inner surfaces openly connected to the cylindrical surface pattern section;

d) said first and second passageway pattern sections being effective to receive an amount of flowable particulate molding material that is sufficient to produce a compacted particulate mass that assumes a shape defined by the inner surfaces of said enclosed tubular passageway means of said caliper casting when a sufficient amount of said flowable particulate molding material is effective to surround said pattern body and fill said inner cavity pattern when said evaporable pattern device is disposed in mold means.

16. A pattern device as defined in claim 15 wherein

said cylindrical surface pattern section includes a pair of inner cylindrical surfaces that are longitudinally spaced with respect to each other along a single longitudinal center axis.

17. A pattern device as defined in claim 16 wherein

said first and second passageway pattern sections have substantially identical inner surface shapes that are symmetrically located with respect to each other on opposed sides of said cylindrical surface pattern section.

18. A pattern device as defined in claim 15 wherein

said first and second passageway surface pattern sections each includes an inner end portion that openly connects to an opposed side of said cylindrical surface pattern section,

said passageway surface pattern sections being effective to form a tubular-shaped passageway surface pattern which is intersected by said parting surface of the pattern body.

19. A pattern device as defined in claim 15 wherein

said first and second passageway surface pattern sections each includes a fluid outlet pattern end portion that extends openly and outwardly through said outer surface pattern, so that when the tubular-shaped passageway surface pattern is viewed in elevation along said parting surface, each passageway surface pattern section includes a substantially identical U-shaped portion, and each said fluid outlet pattern end portion is substantially straight and has one end thereof openly connected to each said U-shaped portion and the other end thereof opens outwardly through said outer surface pattern.

20. A pattern device as defined in claim 15 wherein

said first and second passageway surface pattern sections each includes a fluid connection surface pattern portion having fluid outlet end openings,

said cylindrical surface pattern section includes a pair of inner cylindrical surfaces that are longitudinally spaced with respect to each other along a single longitudinal center axis, and inner end surface pattern portions that openly connect to opposed sides of said cylindrical surface pattern section,

each said inner end surface pattern portion being located along a respective plane of said parting surface with each respective plane being disposed in a direction that is parallel to said longitudinal center axis whereby said respective planes intersect each other along a line that is parallel to said longitudinal center axis.

21. A pattern device as defined in claim 15 wherein

said first and second passageway surface pattern sections each includes an inner end pattern portion that openly connects to an opposed side of said cylindrical surface pattern section, and

said inner end surface pattern portions include tapered sidewall end sections having sidewalls that converge inwardly toward the tubular-shaped passageway means.

22. A disc brake caliper casting comprising:

a) caliper housing means including a front section, a rear section, and a bridge section extending between said front and rear sections;

b) said front, rear, and bridge sections form a cast one-piece structural configuration to integrally define an outer shaped surface and an inner shaped surface;

c) said inner shaped surface including at least one inner cylindrical surface, first cast-in passageway means disposed on a first side of said cylindrical surface, and second cast-in passageway means disposed on an opposed second side of said cylindrical surface;

d) each said first and second passageway means including a cylinder connecting section having an inner end portion that openly connects to said opposed sides of said cylindrical surface;

- e) each said cylinder connecting section being outwardly directed from said inner cylindrical surface and having an outer end portion that extends to said bridge section;
- f) means for forming a fluid connection section that intersects said cylinder connecting sections to produce a continuous fluid flow path between said front section and said rear section;
- g) said fluid connection section forming means including a bridge portion that extends through said bridge section to intersect each said cylinder connecting section, and an outlet end segment that extends outwardly from the bridge section through an outlet opening in said outer shaped surface.

23. A caliper casting as defined in claim 22 wherein

said fluid connection section forming means includes a cast-in fluid connection passageway portion that extends outwardly from each said outer end portion of said cylinder connecting sections across said bridge section and opens outwardly from said outlet end segment.

24. A caliper casting as defined in claim 22 wherein

said bridge section includes two bridge end portions each disposed at an outer end of said front and rear sections,

said front, rear, and bridge sections each includes an inwardly facing surface that together define a friction brake pad support chamber having torque bearing surfaces that are disposed at opposing ends of the support chamber and are perpendicular to the inwardly facing surfaces of the front and rear sections, and

said torque bearing surfaces include disc rotor grooves having a structural configuration that

is effective to allow brake disc rotor means to rotate through the friction brake pad support chamber when a brake caliper that is produced from said caliper casting is mounted to a vehicle.

25. A caliper casting as defined in claim 24 wherein

said front and rear sections each includes an inner cylindrical surface and an inwardly directed cast-in cylinder connecting section on opposing sides of each said inner cylindrical surface, and

each said bridge end portion includes a cast-in fluid connection section extending therethrough with each end thereof intersecting a cast-in cylinder connecting section.

26. A caliper casting as defined in claim 25 wherein

said inner cylindrical surfaces are disposed along a single longitudinal center axis that extends through said front and rear sections, and through said friction brake pad support chamber.

27. A caliper casting as defined in claim 22 wherein

said front, rear, and bridge sections each includes an inwardly facing surface that together define a friction brake pad support zone having a structural configuration effective to allow brake disc rotor means to rotate between friction brake pads mounted in said support zone when a brake caliper that is produced from said caliper casting is mounted to a vehicle,

said fluid connection section forming means includes a cast-in fluid connection passageway portion that extends outwardly from each said outer end portion of said cylinder connecting sections and then extends across said bridge section and opens outwardly from said outlet end segment,

said inner cylindrical surface is disposed in said rear section and has a longitudinal center axis that extends from said rear section and through said friction brake pad support zone with said front section including a front opening which is registered with said inner cylindrical surface and said longitudinal center axis,

said outlet end segment includes an outlet opening having a longitudinal axis that is parallel to said longitudinal center axis of the inner cylindrical surface whereby any machining may be effected on one side of the casting within the inner cylindrical surface in said rear section, within the registered front opening, and along the longitudinal axis of and within said outlet opening.

28. A caliper casting as defined in claim 22 wherein

said bridge section includes two bridge end portions each disposed at an outer end of said front and rear sections,

said front, rear, and bridge sections each includes an inwardly facing surface that together define a friction brake pad support chamber around said support zone,

said support chamber having torque bearing surfaces that are disposed at opposing ends of the support chamber and are perpendicular to the inwardly facing surfaces of the front and rear sections,

said torque bearing surfaces include disc rotor grooves having a structural configuration that is effective to allow brake disc rotor means to rotate through the friction brake pad support chamber when a brake caliper that is produced from said caliper casting is mounted to a vehicle,

said front and rear sections each includes an inner cylindrical surface and an inwardly directed cast-in cylinder connecting section located on opposing sides of each said inner cylindrical

surface, and

each said bridge end portion includes a cast-in fluid connection section extending therethrough with each end thereof intersecting a cast-in cylinder connecting section to produce a fluid flow path.

29. A caliper casting as defined in claim 28 wherein

said outer shaped surface includes friction pad support means for mounting friction brake pad supports within said support chamber, and caliper support means for mounting a machined brake caliper cast housing to a vehicle,

said friction pad support means and said caliper support means each includes a bore opening having a longitudinal axis that is parallel to said longitudinal center axis of the inner cylindrical surface.

30. A caliper casting as defined in claim 28 wherein

said torque bearing surfaces are tapered inwardly and downwardly from a respective bridge end portion with a structural configuration which conforms to the shape of tapered friction brake pad members used in disc brake calipers.

31. A caliper casting as defined in claim 22 wherein

said inner shaped surface includes a pair of inner cylindrical surfaces,

each said first and second cast-in passageway means includes a fluid connection section outwardly directed from each said inner cylindrical surface and having an outlet end that extends

openly and outwardly through said outer shaped surface, and

each said first and second cast-in passageway means includes two opposing inwardly directed cylinder connection sections having inner ends that each openly connect to said pair of inner cylindrical surfaces;

said first and second cast-in passageway means being effective to form a continuous fluid flow crossover path from a first open outlet side to a second closed side of the outer shaped surface so that said path extends through said outlet end of each said passageway means, and through said inner ends that openly connect to each said cylindrical surface.

32. A disc brake caliper casting comprising:

a) caliper housing means including a front section, a rear section, and a bridge section extending between said front and rear sections;

b) said front, rear, and bridge sections having a cast one-piece structural configuration to integrally define an outer shaped surface and an inner shaped surface;

c) said front, rear, and bridge sections each includes an inwardly facing surface that together define a friction brake pad support zone for disposing friction brake pad means on opposing sides of disc brake rotor means; and

d) friction pad support means for mounting said friction brake pad means within said brake pad support zone,

e) said inner shaped surface including at least one inner cylindrical surface having a longitudinal center axis, first cast-in passageway means disposed on a first side of said cylindrical surface, and second cast-in passageway means disposed on an opposed second side of said

cylindrical surface;

f) each said first and second passageway means including a cylinder connecting section being outwardly directed from said inner cylindrical surface, and each having an inner end portion that openly connects to an opposed side of said cylindrical surface, and an outer end portion that extends to said bridge section;

g) said outer shaped surface including a plurality of drilling surfaces each disposed in a respective plane that extends in a direction perpendicular to said longitudinal center axis of the inner cylindrical surface, and caliper support means for mounting a finished brake caliper produced from said brake caliper casting;

h) said bridge section including a drilling surface so that the bridge section may be drilled into for forming a fluid outlet end portion that connects with a crossover fluid flow path that extends through the passageway means and inner cylindrical surface, and

i) said caliper support means including a drilling surface so that said outer shaped surface may be drilled into for forming bore openings to mount said finished brake caliper to a vehicle.

33. A caliper casting as defined in claim 32 wherein

said friction pad support means including a drilling surface so that the outer shaped surface may be drilled into for forming a bore opening to mount said friction brake pad means in said brake pad support zone.

34. A caliper casting as defined in claim 32 wherein

said inner shaped surface includes a pair of inner cylindrical surfaces,
each said first and second cast-in passageway means includes a fluid connection section which is outwardly directed from each said inner cylindrical surface, and said fluid outlet end portion extends openly and outwardly through said outer shaped surface, and
each said first and second cast-in passageway means includes two opposing inwardly directed cylinder connection sections having inner ends that each openly connect to said pair of inner cylindrical surfaces;
said first and second cast-in passageway means being effective to form a continuous fluid flow crossover path from a first open outlet side to a second closed side of the outer shaped surface so that said path extends through said outlet end of each said passageway means, and through said inner ends that openly connect to each said cylindrical surface.

35. A caliper casting as defined in claim 32 wherein

said bridge section includes two bridge end portions each disposed at an outer end of said front and rear sections,

said front, rear, and bridge sections each includes an inwardly facing surface that together define a friction brake pad support chamber having torque bearing surfaces that are disposed at opposing ends of the support chamber and are perpendicular to the inwardly facing surfaces of the front and rear sections, and

said torque bearing surfaces include disc rotor grooves having a structural configuration that is effective to allow brake disc rotor means to rotate through the friction brake pad support chamber when a brake caliper that is produced from said caliper casting is mounted to a vehicle.

36. A caliper casting as defined in claim 35 wherein

said front and rear sections each includes an inner cylindrical surface and inwardly directed cast-in cylinder connecting sections on opposing sides of each said inner cylindrical surface, and

each said bridge end portion includes a cast-in fluid connection section extending therethrough with each end thereof intersecting a cast-in cylinder connecting section.

37. A caliper casting as defined in claim 36 wherein

said inner cylindrical surfaces are disposed along a single longitudinal center axis that extends through said front and rear sections, and through said friction brake pad support chamber whereby said inner cylindrical surfaces may be machined to form finished brake piston cylinders from the same side of said casting as the drilling surfaces are drilled into.

38. A caliper casting as defined in claim 32 wherein

said inner cylindrical surface is disposed in said rear section and has a longitudinal center axis that extends from said rear section and through said friction brake pad support zone with said front section including a front opening which is registered with said inner cylindrical surface and said longitudinal center axis,

said outlet end portion includes an outlet opening having a longitudinal axis that is parallel to said longitudinal center axis of the inner cylindrical surface whereby any machining may be effected on one side of the casting within the inner cylindrical surface in said rear section, within the registered front opening, and along said longitudinal axis of and within said outlet opening.

39. A caliper casting as defined in claim 32 wherein

said bridge section includes two bridge end portions each disposed at an outer end of said front and rear sections,

said front, rear, and bridge sections each include inwardly facing surfaces that define a friction brake pad support chamber around said support zone,

said support chamber having torque bearing surfaces that are disposed at opposing ends of the support chamber and are perpendicular to the inwardly facing surfaces of the front and rear sections,

said torque bearing surfaces include disc rotor grooves having a structural configuration that is effective to allow brake disc rotor means to rotate through the friction brake pad support chamber when a brake caliper that is produced from said caliper casting is mounted to a vehicle,

said front and rear sections each includes an inner cylindrical surface and inwardly directed cast-in cylinder connecting sections on opposing sides of each said inner cylindrical surface, and

each said bridge end portion includes a cast-in fluid connection section extending therethrough with each end thereof intersecting a cast-in cylinder connecting section.

40. A caliper casting as defined in claim 39 wherein

said torque bearing surfaces are tapered inwardly and downwardly from a respective bridge end portion with a structural configuration which conforms to the shape of tapered friction brake pad members used in disc brake calipers.

41. A disc brake caliper comprising:

- a) a front section, a rear section, and two bridge sections each disposed at an outer end of said front and rear sections, and extending between said front and rear sections;
- b) said front, rear, and bridge sections form a one-piece cast configuration to integrally define housing means including an outer shaped surface and an inner shaped surface;
- c) said front, rear, and bridge sections each includes inwardly facing surfaces that define a friction brake pad support zone therebetween;
- d) said front and rear sections each includes a closed piston cylinder and a piston member movably disposed within each said cylinder, and first and second cast-in tubular passageway means for defining a continuous fluid flow path through each said bridge section from passageway inner ends openly connected to opposing sides of said piston cylinders in said front and rear sections, and
- e) fluid connection means extending through at least one of said front and rear sections to be in open fluid flow contact with said tubular passageway means in each said bridge section.

42. A disc brake caliper as defined in claim 41 wherein

said piston members are movably disposed along a common longitudinal center axis, and
said fluid connection means includes fluid outlet end portions having a longitudinal axis that extends along each said bridge section and is parallel to said longitudinal center axis of said piston members.

43. A disc brake caliper as defined in claim 41 wherein
said first and second cast-in tubular passageway means includes fluid outlet end portions
having fluid inlet and outlet ports with a tubular fitting for directing and bleeding fluid through
said passageway means.
44. A disc brake caliper as defined in claim 41 wherein
said cast-in tubular passageway means includes an inner shaped surface having a diameter
of less than about 6.0 mm.
45. A disc brake caliper as defined in claim 41 wherein
said cast-in tubular passageway means includes an inner shaped surface having a diameter
in the range of from about 4.0 mm to about 6.0 mm.
46. A disc brake caliper as defined in claim 45 wherein
the average size of said diameter of the tubular passageway means is about 4.5 mm.
47. A disc brake caliper as defined in claim 41 wherein
said first and second cast-in tubular passageway means have substantially identical inner
shaped surfaces that are symmetrically located with respect to each other on opposed sides of each
said piston cylinder.

48. A disc brake caliper as defined in claim 41 wherein

said first and second cast-in tubular passageway means each includes a fluid outlet end portion and have substantially identical inner shaped surfaces that are symmetrically located with respect to each other on opposed sides of each said piston cylinder,

each said inner shaped surface includes a substantially U-shaped portion, and

each said fluid outlet end portion is substantially straight with one end thereof openly connected to each said U-shaped portion and the other end thereof opening outwardly through said outer shaped surface of said housing means.

49. A disc brake caliper as defined in claim 41 wherein

said closed piston cylinders are longitudinally spaced with respect to each other along a single longitudinal center axis,

each said first and second cast-in tubular passageway includes an inner end portion that openly connects to an opposed side of said closed piston cylinders, a fluid outlet end portion, and has a substantially identical inner shaped surface,

said inner shaped surfaces being symmetrically located with respect to each other on opposed sides of each said piston cylinder, and

each said inner end portion being located along a respective plane that includes one of said bridge sections with each said respective plane being disposed in a direction that is parallel to said longitudinal center axis whereby said respective planes intersect each other along a line that is parallel to said longitudinal center axis.